

Investigating the Effect of Business Intelligence on Business Value Creation

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Abstract

Business Intelligence (BI), a technology-driven process, is considered as a strategic tool which includes the technologies used by enterprises for the data analysis of business information. The purpose of this study is to present a new model to investigating the effect of business intelligence on business value creation. A comprehensive literature review is conducted to identify the factors for the model development. The case study of this research is one of the research institute in Iran. The statistical population of this study is 90 employees of the institute which have been selected by simple random sampling. The researcher designed a Likert-based questionnaire to collect the data from this sample. Validity of the questionnaire was confirmed by the experts in the field of business. The reliability was confirmed by Cronbach's alpha. The results of regression analysis showed that variables of operational and strategic capabilities of business intelligence are effective in business value creation. In addition, the results indicated that knowledge management has a positive mediating effect on the relationships between operational capabilities of business intelligence and business value creation, and strategic capabilities of business intelligence and business value creation.

Keywords: Business Intelligence, Value Creation in Business, Knowledge Management, Organizational strategy

1. Introduction

According to Viva Business Intelligence (Okkonen, Pirttimäki, Hannula, & Lönnqvist, 2002), Business Intelligence (BI) is defined as “business intelligence is a continuous and systematic process producing and communicating actionable intelligence of the external business environment to facilitate proactive decision-making”. Business intelligence is a broad range of techniques, solutions and strategies aimed at collection, consolidation, analysis and providing access to information which allows the managers across the business to make better decisions (Chen, Chiang, & Storey, 2012; Işık, Jones, & Sidorova, 2013; Popović, Hackney, Coelho, & Jaklič, 2012). In fact, business intelligence is a set of skills, technologies and applications that are used to collect, store, analyse and provide efficient access to data warehouses to help organizations make the right decisions. Data analysis includes classification, clustering, statistical analyses, mathematical predictions, intelligent analysis based on neural networks, genetic algorithms and other machine learning techniques. The business intelligence can enhance the business decision-making in a global manner (Rouhani, Ghazanfari, & Jafari, 2012). Business intelligence

methodologies refer to the use of technology to collect and use effective information in order to enhance the productivity of an organization (Grigori et al., 2004; Lee & Park, 2005). The idea of business intelligence for employees, partners and institutional suppliers brings the ability to analyse and share information with each other. Using the roots of business intelligence in basic databases and operating systems, or more generally, using databases, and analytical processing tools, this tool provides a powerful set of useful technologies for different types of user and analytical needs (Fan, Lau, & Zhao, 2015). Implementing this methodology in organizations is part of the IT function and needs to be tailored to meet the specific requirements of the organization (Tutunea & Rus, 2012).

Knowledge, as an important source, has strategic importance to the individuals and organizations. According to (Schultze & Cox, 1998), Knowledge Management (KM) is defined as “the way that organizations create, capture, store, re-use and protect knowledge to achieve organizational objectives”. Knowledge influence the way of welfare for an individual, organization, or even a nation. The long-term success of an organization depends on the acquisition, storage and sharing of knowledge (Bhatt, 2001). Strategies that are designed based on the knowledge

of human resources are the key to competitive advantage. Therefore, successful knowledge management is the main characteristic of the survival of an organization (Cooper, Nash, Phan, & Bailey, 2005; Liebowitz, 1999; Sanchez & Mahoney, 1996).

Innovations are the result of the management of knowledge. In the face of changing environments, innovations will equip the organization with flexibility versus change, and the key to survival and success. According to Herschel & Yermish (2009), “knowledge management technologies are often defined in terms of their ability to help process and organize textual content and data so as to enhance search capabilities and to garner meaning and assess relevance so as to help answer questions, realize new opportunities, and solve current problems”. In the study by Haimila (2001), the author sees KM as the “helping hand of BI”. In addition, it is shown that knowledge is managed using many business intelligence techniques.

There are many studies that find the relationships between the BI and KM, and their integration for the organizational usage (Herschel & Yermish, 2009; Herschel & Jones, 2005). In terms of value creation, BI has been found to be the most promising technologies in recent years (Fink, Yogev, & Even, 2017; Kappelman, McLean, Luftman, & Johnson, 2013). In fact, the recent research shows that the deployment of BI resources creates business value in the organizations (Fink et al., 2017).

The purpose of this study is to present a new model to investigating the effect of business intelligence on business value creation. Specifically, we use the two main types of BI capabilities, strategic BI capabilities and operational BI capabilities (Fink et al., 2017), in the proposed model and find their effect on business value creation. In addition the mediating role of KM on these relationships is also investigated. In other words, the main question of this research is that “*what is the impact of business intelligence on business value creation with mediating role of KM in the Tehran Information and Communication Technology Research Institute?*”

The remainder of this paper is organized as follows. We present the related work in Section 2. In Section 3, we present the methodology of this research. In Section 4, the data analyses are presented. The discussion on the results are provided in Section 5. Finally, the conclusion, limitation and future research are presented in Section 6.

2. Related Work

In the context of BI, several research have been performed which some of them are discussed in this section.

In a study by Fink et al. (2017), the authors investigated the role of BI capabilities, strategic BI capabilities and operational BI capabilities, on strategic and operational business values. They further investigated the role of BI team and BI infrastructure on strategic and operational business values. Their survey was based on IT and business managers perspectives. To analysis the data, they used

covariance-based SEM techniques with the AMOS 20 software and Maximum Likelihood Estimation (MLE). The authors found that operational and strategic BI capabilities should be considered separately in the organizations. They further revealed the significant mediating role of the BI infrastructure in the relationship between the BI team and BI capabilities. Moreover, the found that effect of strategic BI capabilities on operational business value was not significant.

Cooper, Watson, Wixom, & Goodhue (2000) conducted an empirical study and developed a framework for understanding the typical growth path of a data warehouse initiative for the client-centric strategy, improvement in financial performance. Popovič et al. (2012) conducted an empirical study for firm-level analysis of BI-related factors that influence the use of information in business processes. Ramakrishnan, Jones, & Sidorova (2012) performed a survey-based firm-level analysis of factors that direct BI investments. (Işık et al., 2013) provided an empirical study for firm-level analysis of factors that influence BI success. Vukšić, Bach, & Popovič (2013) developed a multiple case study to analyze the impact of business process management and BI in different industries. Rubin & Rubin (2013) conducted a study for the analysis of the association between BI investments and stock return volatility, based on public-domain data. Popovič, Turk, & Jaklič (2010) developed a conceptual framework to link business performance and value to BI maturity, information quality, and the use of information in business processes. Maghrabi, Oakley, Thambusamy, & Iyer (2011) developed a model to explain the contribution of BI by distinguishing between explorative and exploitative usages. Lin, Tsai, Shiang, Kuo, & Tsai (2009) conducted a study based on Analytic Network Process (ANP) to assess the effectiveness of BI systems. The major criteria of their model were: Service and Integration Ability (SIA), Meeting Enterprises Requirements (MER), Meeting User’s Needs (MUN) and Functions of a BI System (FBIS). The sub-criteria (performance indicators) were: System Response Time (SRT), System Security (SS), Output Information Accuracy (OIA), Implementing Experiences of Consultant (IEC), Support of Organizational Efficiency (SOE), Support Degree of Users and High Management Level (SDUH), Conformity to the Requirement (CR), Comprehension Degree to Implementer’s Business (CDIB) and Support in Decision-Making in Organization (SDM). Lee, Lau, Ho, & Ho (2009) designed and developed an agent-based procurement system to enhance business intelligence. Their case study was a manufacturing small and Medium-Sized Enterprise (SME).

3. Methodology

In Section 2, we have discussed some research on BI. From the literature review, we found that BI can play an important role in business value creation. In case of information and communication technology research institutes, the results of our investigation showed that there is no study to show that whether the BI can have significant

impact on BI value creation. In addition, there is a lack of study to reveal the impact of KM on BI in research institutes. Although some research have investigated this context in business companies, impact of KM on BI and BI capabilities on value creation is never investigated in the context of in information and communication technology research institutes. Accordingly, in this research a new model is developed to investigate the roles of KM and BI on business value creation. Specifically, the mediating role of KM is evaluated for the relationship between BI capabilities and business value creation. Our research framework includes the following hypotheses.

H1: Operational capabilities has positive effect on BI business value creation.

H2: Strategic BI capabilities has positive effect on BI business value creation.

H3: Knowledge management has a positive mediating effect on the relationships between operational BI capabilities and business value creation.

H4: Knowledge management has a positive mediating effect on the relationships between strategic BI capabilities and business value creation.

In addition, in H3 and H4, we will investigate whether KM can mediate the effect of operational and strategic BI capabilities on business value creation.

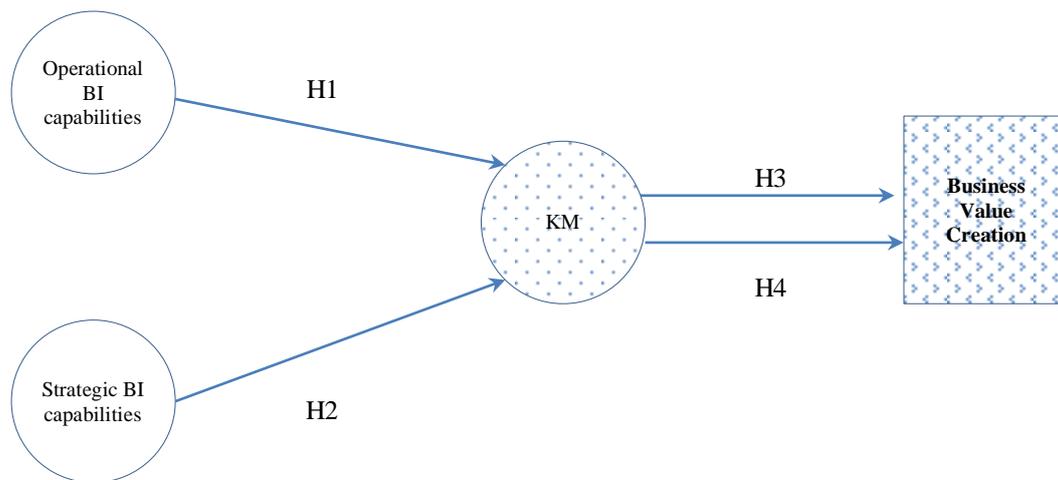


Fig. 1. Proposed research model

4. Data collection and Analysis

Since the research is a descriptive-survey study in terms of data collection, a questionnaire was designed according to the variables of the research model and with the opinion of the managers and staffs who had experience in implementing ICT in organizations. The statistical population of this research is managers and staff of a Research Institute. According to the collected data, the total population of the research was 90 respondents. According to the results of the first part of the questionnaire, it was found that, from the total of 90 participants in this study, 32 (35.6%) respondents were male and 58 (64.4%) respondents were female. In addition, 25 (27.7%) respondents had Bachelor's degree and 55 (72.2%) had Master degrees and 10 (11.11) respondents had PhD degree. Furthermore, 16 (17.78%) respondents were 25-35 years old, 62 (68.89%) respondents were 36-45 years old, and 12 (13.33%) respondents were 55-46 years old. Moreover, 5 respondents had 5 to 10 years ICT experience, 65 had 15 to 20 years ICT experience and 20 had more than 20 years of ICT experience.

The questionnaire used in this research is Likert-based with numerical scale. Therefore, each question examines only one variable, and according to the responses of the participants, a numerical value between 1 and 5 was assigned to each item. In this research, Cronbach's alpha

was used to test the reliability of the questionnaire. The results are provided in Table 1. The results show that the Cronbach's alpha values are acceptable for all construct of the model. The ranges of Cronbach's alpha values are between 0.852 and 0.954, which are greater than 0.70.

Table 1

The Cronbach's alpha result.

Construct	Cronbach's alpha
Operational BI capabilities	0.940
Strategic BI capabilities	0.852
Knowledge Management	0.863
Business Value Creation	0.954

For hypotheses analysis, we used regression test. In the regression test, the relation between the independent and dependent variables is evaluated.

For H1 and H2, which we assumed that operational and strategic capabilities have positive effect on business value creation, the result of regression test is provided in Table 2. The result of this analysis shows that independent variables have predicted accurately the dependent variable (Business Value Creation).

Table 2

Regression test for hypotheses

Hypothesis No.	R	R ²	Adjusted R ²	Estimated standard error
H1	0.888	0.788	0.786	1.53
H2	0.706	0.498	0.492	2.36

To further analysis these two hypotheses, analysis of variance is conducted. The results are provided in Table 3. The results show that, there is significant relationship between operational and strategic capabilities business value creation in the model.

Table 3

Analysis of variance

Hypothesis No.	$\sum R^2$	Df.	F	Sig.
H1	774.89	1	327.68	0.00
H2	489.42	1	87.261	0.00

For H3 and H4, which assume that knowledge management has a positive mediating effect on the relationships between operational and strategic BI capabilities, and business value creation, the relationships: Knowledge Management→Strategic BI Capabilities, Knowledge Management→Operational BI Capabilities, Knowledge Management→Business Value Creation, Operational BI Capabilities→Business Value Creation and Strategic BI Capabilities→Business Value Creation are evaluated. The results are provided in Table 4. The results show that knowledge management has a positive mediating effect on the relationships between operational and strategic BI capabilities and business value creation.

Table 4

Results of data analysis for H3 and H4

Hypothesis No.	Relationship	Factor loading	t-value	Sig.
H3	Knowledge Management→Operational BI Capabilities	0.327	0.460	0.00
	Knowledge Management→Business Value Creation	0.844	0.925	0.00
	Operational BI Capabilities→ Business Value Creation	0.614	0.509	0.00
H4	Knowledge Management→Strategic BI Capabilities	0.890	1.027	0.00
	Knowledge Management→Business Value Creation	0.913	1.677	0.00
	Strategic BI Capabilities→ Business Value Creation	0.087	2.523	0.00

5. Discussions

In this research, the overall findings of data analysis are as follows:

- i. First, the result of our data analysis showed that both operational BI capabilities and strategic BI capabilities can improve the business value creation in our case study. This finding is supported by the previous research on business intelligence context (Fink, Yogevev, & Even, 2017).
- ii. Second, with regards to the significance level of 0.01, we found that there is a significant positive relationship between two variables of knowledge management and operational capabilities of business intelligence on business value creation in the model. The degree of the effect of knowledge management on operational capabilities of business intelligence was 0.327, knowledge management on business value creation was 0.844 and operational capability of business intelligence on business value creation was 0.614. Accordingly, it can be concluded that the mediating role of knowledge management was significant. This result is in line with some previous studies (e.g., Fink, Yogevev, & Even, 2017) who earlier reported that operational capabilities of business intelligence can have

- iii. Third, with regards to the significance level of 0.01, we found that there is a significant positive relationship between two variables of knowledge management and strategic capabilities of business intelligence on business value creation in the model. The degree of the effect of knowledge management on strategic capabilities of business intelligence was 0.890, knowledge management on business value creation was 0.913 and operational capability of business intelligence on business value creation was 0.087. Accordingly, it can be concluded that the mediating role of knowledge management was significant. This result is in line with some previous studies (e.g., Fink, Yogevev, & Even, 2017) who earlier reported that operational capabilities of business intelligence can have significant effect on business value. In addition, the results of our study, which shows that knowledge management play an important role in business value creation, are supported by the study conducted by Dzenopoljac, Alasadi, Zaim, & Bontis (2018). This study has also found that

knowledge management can positively influence the business performance in research institutes.

6. Conclusions

In this paper, attempts have been made to develop a new model to investigate the roles of business intelligence and knowledge management in business value creation. Accordingly, four hypotheses were developed in this research and the data was collected from 90 managers and staffs who had experiences in implementing ICT in the organizations. Regression test was applied on the collected data for hypotheses testing. The results of hypotheses testing revealed that all hypotheses are significant. The results further revealed the importance role of knowledge management in improving the effect of operational BI capabilities and strategic BI capabilities on business value creation.

6.1. Limitations and future work

This research includes some limitations which are summarized as follows:

- i. With regards to the investigated factors, this research investigated a limit number of factors on business value creation. Accordingly other factors such as System Response Time (SRT), System Security (SS), Output Information Accuracy (OIA), Implementing Experiences of Consultant (IEC), Support of Organizational Efficiency (SOE), Support Degree of Users and High Management Level (SDUH), Conformity to the Requirement (CR), Comprehension Degree to Implementer's Business (CDIB) and Support in Decision-Making in Organization (SDM) also can be incorporated to the proposed for further investigation.
- ii. With regard to the sample size, only 90 respondents have participated for data collection. Hence, future studies can rely on more population size to better confirm the results of our research.
- iii. With regard to the methodology and method used for data analysis, this research can be further developed by other statistical techniques. In addition, the experts' perspectives can be better analysed and interpreted with multi-criteria decision making techniques such as Fuzzy Inferences Systems (Torbaty et al., 2018), Decision Making Trial and Evaluation Laboratory (DEMATEL) (Nilashi et al., 2015), Hierarchical Process (AHP) (Zare et al., 2016), Analytic Network Process (ANP) (Nilashi et al., 2016), and the integrations of statistical, multi-criteria decision making and fuzzy logic approaches (Yadegaridehkordi et al., 2018a; Yadegaridehkordi et al., 2018b).

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